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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/955,738	09/18/2001	Jason H. Hafner	HUV-050.01	9454

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EXAMINER
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LISH, PETER J

ART UNIT	PAPER NUMBER
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1754

DATE MAILED: 07/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/955,738

Applicant(s)

HAFNER ET AL.

Examiner

Peter J Lish

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-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 14 May 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-13, 15-24 and 26-36 is/are pending in the application.
- 4a) Of the above claim(s) 26-36 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 24 is/are allowed.
- 6) ☒ Claim(s) 1-13 and 15-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

### **DETAILED ACTION**

Applicant's election with traverse of Group I in Paper No. 10 is acknowledged. The traversal is on the ground(s) that there is no undue burden to the examiner. This is not found persuasive because of the reasons given in paper #9, specifically that the combination does not require the particulars of the subcombination, which thereby yields a burden of search.

The requirement is still deemed proper and is therefore made FINAL.

This application contains claims 26-36 drawn to an invention nonelected with traverse in Paper No. 10. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Applicant's arguments filed May 14, 2003, have been fully considered but they are not persuasive. Regarding applicant's argument that the instantly claimed invention does not recite 'performing a translation', despite the new limitations in the claims brought about by the amendment of "comprising" to "consisting", the translation of the reference is simply the movement of the AFM tip which allows for the attachment of the SWNT to the tip. The translation is therefore not an additional step, but rather the step of attaching a nanotube to the tip.

Regarding applicant's arguments that a temperature of 900 °C would not be a temperature suitable for curing an adhesive resin, the arguments have been fully considered and are persuasive.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Kong et al. ("Synthesis of individual single-walled carbon nanotubes on patterned silicon wafers").

Kong et al. teach the growth of single-walled carbon nanotubes via chemical vapor deposition. They also teach the imaging of the substrate using AFM. The picking up of a single-walled carbon nanotube by the AFM tip during imaging is seen to be inherent to the process. Therefore, no difference is seen between the process of Kong et al. and that of the applicant.

***Claim Rejections - 35 USC § 103***

Claims 1 and 20-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al. (WO 98/05920) taken with Kong et al. ("Synthesis of individual single-walled carbon nanotubes on patterned silicon wafers").

Colbert et al. disclose a method for the attachment of a single-walled carbon nanotube to the tip of an atomic force microscope (AFM). They teach that by bringing the tip next to the nanotube and performing a translation, the van der Waals forces promote bonding between the nanotube and the tip.

Colbert et al. do not teach any particulars about the nanotube sample which is used, they rather disclose that the nanotube assembly is preferably prepared from isolated, purified carbon nanotubes (page 8, lines 1-11). Kong et al. teach a method of growing perfect, individual single-walled nanotubes on a substrate using a chemical vapor deposition process. It would have been obvious to one of ordinary skill at the time of invention to use the single-walled nanotube assembly of Kong et al. for the process of Colbert et al. in order to provide an isolated and pure single-walled carbon nanotube sample.

Colbert et al. also do not teach a process of imaging the substrate using an atomic force microscope. However, Kong et al. teach that the vapor-grown nanotubes are easily located, characterized, and manipulated with the atomic force microscope (abstract). Furthermore, sample characterization was carried out using an AFM, which resulted in Figures 2 and 3. It would have been obvious to one of ordinary skill at the time of invention to image the substrate using an atomic force microscope, as taught by Kong et al., to locate and characterize the nanotube-substrate sample before proceeding with the attachment process of Colbert et al.

Regarding claims 23-24, Colbert et al. disclose that an adhesive may be applied to the tip prior to the attachment procedure (page 13, line 17 to page 14, line 2). It is further taught that in the case of the adhesive requiring a cure, the appropriate conditions, such as UV light, heat, etc. is provided after the nanotube is attached.

Regarding claims 20-22, Kong et al. disclose that the SWNTs have diameters of between 1 and 3 nm. Therefore, it would have been obvious to one of ordinary skill to select a nanotube with a diameter of 3 nm for use in the process of Colbert et al.

Claims 2-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al. and Kong et al. as applied to claim 1 above, and further in view of Smalley et al. (PCT/US98/04513).

Kong et al. do not specifically teach that the carbon nanotubes are grown normal to the substrate. However, Smalley teaches a process whereby a macroscopic array of single-walled nanotubes may be formed on a silicon substrate by the growth of SWNTs through chemical vapor deposition and the subsequent aligning of the SWNTs using an electric field (page 13, paragraph 0158). It would have been obvious to one of ordinary skill at the time of invention to

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align the nanotubes of Kong et al. in a single direction, perpendicular to the substrate, in order to ease the finding of an isolated nanotube in the process of Colbert et al.

Regarding claims 3-11, Kong et al. teach the growth of single-walled nanotubes on a metallic catalyst which is supported on a silicon wafer substrate. The process of Kong involves the deposition of the metallic catalyst on the silicon substrate and the exposure of the silicon wafer to a carbon-containing gas under conditions to promote growth of single-walled nanotubes. The catalyst deposition involves a ferric salt of ferric nitrate in solution with methanol (footnote Figure 1, b). Regarding claim 11, the alcohol solvent is removed from the substrate by vaporization. The selection of one alcohol, specifically isopropanol, over another, such as methanol, would have been obvious to one of ordinary skill in the art unless applicant shows significantly different and unexpected results.

Regarding claims 12 and 13, methane is used as the carbon-containing feedstock because it is the most kinetically stable hydrocarbon at elevated temperatures. However, it would have been obvious to one of ordinary skill to substitute ethylene for the methane feedstock of Kong et al., as it too is a commonly used carbon-containing feedstock for the chemical vapor deposition growth of single-walled carbon nanotubes.

Claims 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al. and Kong et al. and Smalley et al. as applied to claim 1-3 above, and further in view of Ago et al. ("Dispersion of metal nanoparticles for aligned carbon nanotube arrays").

Kong et al. does not teach a method of depositing the metallic catalysts on the silicon wafer using metallic colloid particles. However, Ago et al. disclose a process of dispersing metallic catalyst nanoparticles on a silicon substrate which involves the use of metallic colloid

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particles. Specifically, a colloidal solution of nickel particles is used to deposit the catalyst onto the silicon substrate. However, it would have been obvious to one of ordinary skill at the time of invention to use a colloidal solution of an equivalent metal particle, such as iron, in order to accomplish the catalyst deposition. Ago et al. also teach that the average diameter of the catalyst nanoparticles was about 4 nm (page 79, 2<sup>nd</sup> column).

Regarding claim 18, whereas acetylene is used as the carbon-containing feedstock of Ago et al., it would have been obvious to one of ordinary skill at the time of invention to substitute ethylene, as it too is a commonly used carbon-containing feedstock for the chemical vapor deposition growth of single-walled carbon nanotubes.

#### ***Allowable Subject Matter***

Claim 24 is allowed.

#### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter J Lish whose telephone number is 703-308-1772. The examiner can normally be reached on 9:00-6:00 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 703-308-3837. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-305-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.



PL  
July 25, 2003

STUART L. HENDRICKSON  
PRIMARY EXAMINER